

Instructions

To help WSDOT understand the functioning and performance of the technology and thereby facilitate the Technical Audit, Applicants are urged to spend the time necessary to provide clear, complete and detailed responses. A response on all items that could possibly apply to the system or its components, even those where evaluation protocol has not been fully established, would be of interest to WSDOT. Any omissions should be noted and explained.

Responses should be organized in the order shown and referenced to the given numbering system. Additionally, duplication of information is not needed or wanted. A simple statement referencing another section is adequate.

Part One: Materials and Material Properties

Provide a sample of the reinforcement material and material specifications describing the material type, quality, certifications, lab and field testing, acceptance and rejection criteria along with support information for each of the following material items. Include representative test results (lab and/or field) clearly referencing the date, source and method of test, and, where required, the method of interpretation and/or extrapolation. Along with the source of the supplied information, include a listing of facilities normally used for testing (i.e., in-house and independent).

1.1 Facing Unit

Yes	No	N/A	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	• standard dimensions and tolerances
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	• joint sizes and details
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	• concrete strength (minimum)
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	• wet cast concrete % air (range)
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	• dry cast concrete density (minimum or range)
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	• moisture absorption (percent and by weight)
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	• salt scaling
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	• freeze thaw durability factor
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	• facing unit to facing unit shear resistance
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	• bearing pads(joints)
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	• spacers (pins, etc.)
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	• joint filter requirements: geotextile or graded granular
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	• aesthetic choices (texture, relief color, graffiti treatment)
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	• other facing materials

1.2 Earth Reinforcement

1.2.1 Metallic

- manufacturing sizes, tolerances and lengths:

Yes	No	N/A	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	- ultimate and yield strength of steel
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	- minimum galvanization thickness for 75 year design life
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	• sacrificial steel thickness for 75 and 100 year design life
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	• corrosion resistance test data
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	• pullout interaction coefficients for range of backfill

1.2.2 Geosynthetics

For geosynthetic reinforcement, the short and long-term tensile properties and material requirements shall be developed in conformance to WSDOT Standard Practice T925. For geosynthetic materials not specifically covered by T925, justification shall be provided that demonstrates the appropriateness of the data submitted and its analysis; however, the overall approach in T925 shall be used in such cases.

- polymer type and grade:

Yes	No	N/A	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	- HDPE: resin type, class, grade & category
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	- PP: resin type, class, grade & category
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	- PET: minimum intrinsic viscosity correlated to number average molecular weight and maximum carboxyl end groups
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	- post-consumer recycled material, if any
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	- weight per unit area

- minimum average roll value for ultimate strength:

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	- coefficient of variation for ultimate strength
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	- minimum average roll value for QC strength (e.g. single rib, grab, or strip)
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	• creep reduction factor for 75 and 100 year design life, including effect of temperature (200C to 400C)
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	• durability reduction factor (chemical, hydrolysis, oxidative) for 75 and 100 year design life
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	• additional durability reduction factor for high biologically active environments
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	• installation damage reduction factor for range of backfill (i.e., sand, sandy gravel, gravel, coarse gravel)
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	• junction strength for quality control
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	• seam strength
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	• pullout interaction coefficients for range of backfills
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	• embedment scale factor
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	• coatings (type and amount)
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	• UV inhibitors, coatings, etc.
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	• UV resistance

1.3 Facing Connection(s)

Yes	No	N/A	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	• mode (i.e., structural, frictional or combined)
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	• connection strength as a % of reinforcement strength at various confining pressures for each reinforcement product and connection type submitted
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	• composition of devices, dimensions, tolerances
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	• full scale connection test method/results

1.4 Range of Backfill

- reinforced

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	- soil classification, gradation, unit weight, friction angle
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- facing

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	- soil classification, gradation, unit weight, friction angle
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1.5 Leveling Pad

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	• cast-in-place
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	• precast
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	• granular

1.6 Drainage Elements

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	• weep holes
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	• base
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	• backfill
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	• surface

1.7 Coping

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	• precast
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	• precast attachment method/details
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	• cast-in-place

1.8 Traffic Railing/Barrier

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	• precast
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	• cast-in-place

1.9 Connections to Appurtenances

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	• precast
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1.10 Other Materials

Yes	No	N/A	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	• corner elements
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	• slip-joint elements

1.11 Quality Control/Quality Assurance Systems material suppliers

- material suppliers:

Yes	No	N/A	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	- metallic reinforcement
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	- polymeric reinforcement
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	- concrete products
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	- backfill
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	• fabricator(s)
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	• test facilities (internal and external)

Part Two: Design

Provide design assumptions and procedures with specific references (e.g., design code section) for each of the following items. Clearly show any deviations from the WSDOT Geotechnical Design Manual (GDM), LRFD Bridge Design Manual (BDM) and the AASHTO LRFD Bridge Design Specifications, along with theoretical or empirical information, which support such deviations.

2.1 External Stability

Yes	No	N/A	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	• sliding
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	• overturning (including traffic impact)
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	• bearing capacity (overall and local)
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	• seismic
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	• settlement (total and differential)
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	• recommended wall embedment

2.2 Internal Stability

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	• assumed failure surface
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	• distribution of horizontal stress
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	• surcharge
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	- concentrated dead load
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	- sloped surcharge
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	- broken-back surcharge
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	- live load
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	- traffic impact
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	- lateral loads from piles, drilled shafts within reinforced backfill
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	• allowable tensile strength of the reinforcement

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	• pullout
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	• facing connections
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	• vertical and horizontal spacing (including traffic impact requirements)

Yes	No	N/A	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	• facing design
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	- connections
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	- concrete strength requirements
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	• effective face batter
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	• compound/global stability
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	• seismic considerations
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	• design modification for tiered structures, acute corners and obstructions

2.3 Performance Criteria

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	• ultimate strength of reinforcement service limit
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	- for steel, F_y and F_u
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	- for polymeric, strength at % strain
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	• long-term design strength
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	• material properties, requirements and test standards
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	• horizontal/vertical deflection limits

2.4 Plan Sheets

Provide representative plan sheets showing all standard details along with any alternate details, including the following:

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	• details for wall elements
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	• connection details
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	• appurtenance connection details
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	• obstruction detail (utilities, parapet/sidewalk connection, light standard and box)
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	• corrosion/durability protection details
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	• construction details
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	• optional details

2.5 Specifications

Provide sample specifications for:

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	• materials
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	• installation
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	• construction
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	• maintenance

2.6 Aesthetic Compliance

Detail the provisions in material specifications for aesthetics compliance, including:

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	• texture
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	• color

Yes	No	N/A	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	• graffiti treatment for facing panels
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	• durability of aesthetic features

2.7 Limitations

List any and all design limitations, including:

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	• seismic loading
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	• environmental restraints
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	• wall height, external loading
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	• other _____

2.8 Example Calculations

Provide detailed (hand) design calculations for a 10, 20, and 33 ft high wall with a 2H:1V sloping soil surcharge (extending from the back face of the wall to an infinite distance behind the wall) in conformance with the WSDOT Geotechnical Design Manual (GDM), LRFD Bridge Design Manual (BDM), and the AASHTO LRFD Bridge Design Specifications (or AASHTO Standard Specifications for Highway Bridges as specifically allowed in the WSDOT GDM) and using any deviations from those specifications you are proposing. The calculations should address the technical review items listed above. The example designs shall be completed with seismic forces (assume a PGA of 0.33g). If the wall is not competitive at one of the above heights, data for that wall height need not be submitted. In addition, a 10 ft high example wall shall be performed with no soil surcharge and a traffic barrier placed on top of the wall at the wall face. The barrier is to be of the “F shape” configuration and capable of resisting a 10K load. An example, and associated details, shall also be provided for the 20 ft high case, but with no soil surcharge, when a 3 ft diameter sign bridge foundation 10 ft deep is placed in the backfill 5 ft behind the wall face (5 ft clear distance). List any deviations from the GDM, BDM and AASHTO Specifications.

2.9 Computer Support

If a computer program is used for design or distributed to customers, provide representative computer printouts of design calculations for the above typical applications demonstrating the reasonableness of computer results.

2.10 Quality Control/Quality Assurance Systems

Include the system designer’s Quality Assurance program for evaluation of conformance to the quality control program.

Part Three: Construction

Provide the following information related to the construction of the system:

3.1 Fabrication of Facing Units

Yes	No	N/A	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	• curing times
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	• form removal
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	• concrete surface finish requirements

3.2 Field Construction Manual

Provide a documented field construction manual describing in detail and with illustrations as necessary the step-by-step construction sequence, including requirements for:

Yes	No	N/A	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	• foundation preparation
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	• special tools required
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	• leveling pad
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	• facing erection
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	• facing batter for alignment
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	• steps to maintain horizontal and vertical alignment
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	• retained and backfill placement/compaction
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	• erosion mitigation
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	• all equipment requirements

3.3 Construction Specifications

Include sample construction specifications, showing field sampling, testing and acceptance/rejection requirements.

3.4 Construction Case Histories

Provide construction case histories and photos/videotapes from projects illustrating the construction process.

3.5 Contractor or Subcontractor Prequalification Requirements List any contractor or subcontractor prequalifications.

3.6 List of Contractors and Subcontractors

Provide a list of installation contractors who have constructed this system, including contact persons, addresses and telephone numbers.

Provide a list of precasters.

3.7 Quality Control/Quality Assurance of Construction

Describe the quality control and quality assurance measurements required during construction to assure consistency in meeting performance requirements.

Part Four: Performance

Provide the following information related to the performance of the system:

4.1 Warranties

Provide a copy of any system warranties.

Yes.	No	N/A	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

4.2 Designated Responsible Party

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	• system performance
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	• material performance
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	• project-specific design (in-house, consultant)

4.3 Insurance Coverage for Responsible Party

List insurance coverage types (e.g., professional liability, product liability, performance) limits, basis (i.e., per occurrence, claims made) provided by each responsible party

4.4 Project Performance History

Provide a well documented history of performance (with photos, where available), including:

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	• oldest
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	• highest
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	• projects experiencing maximum measured settlement (total and differential)
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	• measurements of lateral movement/tilt
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	• demonstrated aesthetics
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	• project photos
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	• maintenance history

4.5 Numerical Model Studies

Provide case histories on numerical model studies.

4.6 Instrumented Structures

Provide case histories of instrumented structures.

4.7 Field Tests

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	• construction testing
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Yes	No	N/A	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	• pullout testing
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	• crash baffler testing
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	• seismic load test

4.8 Construction/in-Service Structure Problems

Provide case histories of structures where problems have been encountered, including an explanation of the problems and methods of repair.

4.9 Unit Costs

Provide typical unit costs in \$/ft² of vertical face, supported by data from projects.

4.10 Maintenance

Provide a listing of maintenance requirements to maintain performance and repair damage. If available, provide a maintenance manual.

4.11 Quality Control History

Provide the history for the system and material quality along with improvements that have been made based on the experience with the system.

4.12 List of Users

Provide a list of users, including contact persons, addresses and telephone numbers.